**A PROJECT REPORT**

On

# SOIL MOISTURE MONITORING

Submitted in partial fulfilment for the award of the degree

Of

## BACHELOR OF TECHNOLOGY

## In

## COMPUTER SCIENCE AND BUSINESS SYSTEMS

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# BONAFIDE CERTIFICATE

Certified that this is the bonafide record of work done by

of **VII semester** B.Tech., COMPUTER

SCIENCE AND BUSINESS SYSTEMS during the academic year 2022- 2023 in the **18CSE462J-INTRODUCTION TO INTERNET OF THINGS** Laboratory.

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Submitted for the practical examination held on\_\_\_\_\_\_\_\_\_\_\_\_ at SRM Institute of Science and Technology, Kattankulathur, Chennai-603203.

Internal Examiner External Examiner

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# ABSTRACT

The efficient irrigation management practices based on the monitoring of the moisture in the soil provide a great benefit for the appropriate amount of water applied in the fields. This paper presents design and development of a soil moisture sensor and a response monitoring system. The probes used in this sensor are made of nickel which is an anti-corrosive and robust material for use in agricultural related applications.The response monitoring system measure the moisture of the soil, compare it with the desired values given by the user and generate alert if soil moisture goes below desired value. It helps in problems related to growing of crops in which irrigation is required at irregular interval. It is also helpful in monitoring of soil moisture in golf fields. The IoT features provided by NodeMCU are used to transfer the data like moisture value in the soil, temperature etc. from agriculture field onto the cloud. Previous works involve irrigation without human intervention, but this work provides many more add-ons like being able to access the field condition using mobile or through web page. The user is also given opportunity to control the motor using his/her mobile with a pre-defined condition of mobile and NodeMCU getting connected to the same internet

**INTRODUCTION**

In order to improve the Subsurface drip irrigation (SDI being adopted in areas to conserve water; we have proposed this work [1]. Soil moisture (SM) is a crucial part in the lifecycle of a plant, which influences crop development resulting in high yield. SM is extremely unpredictable and influenced by a variety of things such as soil type, water absorption capacity, climatic conditions, and changes with alteration of depth. During initial days, soil moisture sensors couldn’t produce accurate values. The upgradation made in the measuring Soil moisture values produced sensors which can produce highly accurate values. Irrigation water management practices could greatly benefit by the knowledge of moisture in the soil. To determine the soil moisture we have designed and developed a nickel probes based soil moisture sensor and a response monitoring system. By knowing the moisture value, we can estimate when to water and how much to water the fields so that there is no over-watering or wilting of crops. These practices will increase crop yield, improve quality of crops, conserve water resources, save energy, and decrease fertilizer supplies.

**What is IoT?**

The Internet of Things (IoT) is the ability to have devices communicate with one another via the internet or other networks, remotely tracking information to provide feedback to assist with decision making for commercial, industrial and residential purposes. This is commonly done using sensors connecting to a back-to-base system.

Some common day-to-day examples could be:

* Temperatures in refrigeration or food heating units in the food and beverage industry.
* Assistance with the control of temperature and humidity levels.
* Detection of gas and dust levels.
* Monitoring of water levels and herd locations for agricultural purposes.
* Different applications in the automotive, aviation and nautical sectors such as the sensing of tyre pressures for trucking fleets.

**Applications of IoT :**

Smart Door access control system.

Smart lighting for home and office.

Automated Gate and garage.

Smart thermostats and humidity controllers.

Traffic Management.

Smart lighting on streets.

Pollution monitoring and reporting.

Smart Parking Solutions.

**Types of IoT :**

Consumer Internet of Things (CIoT)

Commercial Internet of Things

Industrial Internet of Things (IIoT)

Infrastructure Internet of Things

Internet of Military Things (IoMT)

**What is Soil Moisture Monitoring?**

* Soil moisture monitoring is critical for managing water resources in an efficient manner.
* This applies to both irrigated and rainfed cropping systems.
* Water is increasingly becoming the most limiting resource needed to meet the food and fiber needs of a growing and more affluent population.
* Soil moisture monitoring can e.g. be used as a tool to assist irrigation scheduling.
* Irrigation management gives better crops, using fewer inputs, which increases profitability.
* Soil moisture sensors help with irrigation decisions.
* They are useful tools to understand what is happening in the root zone of your crop.

**It is suitable for :**

* Small-scale farmers
* Agriculture industry
* Rain-fed and irrigated agriculture

**LITERARTURE SURVEY**

* Jyothipriya et al (2013) :The GSM based Zigbee Controlled Solenoid Valve for dripirrigation system proves to be a real time feedback control system which monitors and controls all the activities of drip irrigation system efficiently Using this system, one can save manpower, water and power consumption is reduced by 20% and 30% when compared to existing.
* Ganesh et al (2013) : objective is to detect other white fly stages and other bioagressors or plant diseases, it is simple to introduce new objects to detect or new image processing programs to extract the corresponding information. We propose an original approach fo rearly detection of bio agressors, which It is rather simple to use and exhibits the same performance level as a classical manual approach. Moreover, it detects whiteflies three timesfaster and it covers three times more leaf surface. The context of our work is to automateoperations in greenhouses. Our goal is rather to better spot the starting points of bioagressorsattacks and to count these latter so that necessary action can be taken.
* Galande et al (2013) :The Microcontroller based automized drip irrigation system usingwireless technique proves to be a real time feedback control system which monitors andcontrols all the activities of drip irrigation system efficiently. The present proposal is a modelto modernize the agriculture industries at a mass scale with optimum expenditure. Using thissystem, one cansave manpower, water to improve production and ultimately profit. Thedeveloped irrigation automation system can beproposed to be used in several commercialagricultural productions since it is obtained in low cost and in reliable operation. Thisapplication of sensor-based site- Specific irrigation has some advantages such as preventingmoisture stress of trees, diminishing of excessive water usage, ensuring of rapid growingweeds and derogating salification. If different kinds of sensors (that is, temperature, humidity,and etc.) are involved in such irrigation in future works, it can be said that an internet basedremote control of irrigation automation will be possible. The developed system can alsotransfer fertilizer and the other agricultural chemicals (calcium, sodium, ammonium, zinc) to the field with adding new sensors and valves.
* Sanjukumar et. al. (2013) : The Soil moisture content based irrigation system

wasdeveloped and successfully implemented along with flow sensor. Salient features of thesystem are: Closed loop automatic irrigation system, temperature and water usagemonitoring. User can easily preset the levels of the Moisture and is regularly updated aboutcurrent value of all Parameters on LCD display. In future, other important soil parametersnamely soil pH, soil electrical conductivity will also be incorporated in the system

**REQUIRED COMPONENTS**

* Node MCU (ESP8266-12E Board)
* OLED Display (0.96" I2C OLED Display)
* Connecting Wires (Jumper Wires)
* Breadboard
* Soil Moisture Sensor (Resistive Soil Moisture Sensor LM393 Based )
* Some amount of Soil

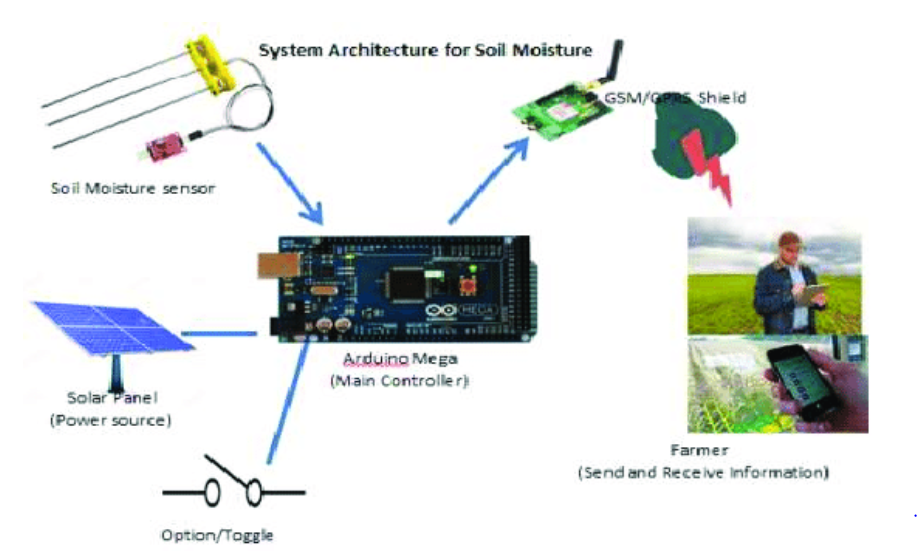
**Node MCU (ESP8266-12E Board)**

* New NodeMcu Lua ESP8266 CH340G ESP-12E Wireless WIFI Internet Development Board ESP12E is a WIFI enabled Arduino-alike development board, Which can dramatically reduce the redundant work for configuring and manipulating hardware.
* Code like arduino, but interactively in Lua scipt.
* Nodejs style network API.

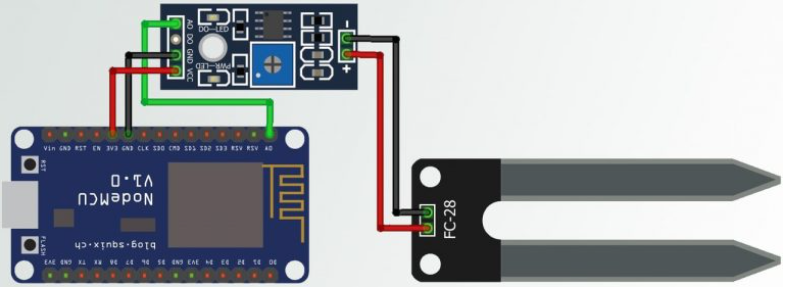
**Soil Moisture Sensor (Resistive Soil Moisture Sensor LM393 Based)**

* A soil moisture sensor as the name indicates is used to determine the moisture present in the soil.
* The moisture of the soil depends upon various factors such as type of soil whether its sandy, clay, loam, sandy loam and salts present in soil such as iron, manganese, calcium, phosphorus, nitrogen, sulphur etc. it also depends upon temperature.
* Based on the reading of moisture sensor, irrigation is done.
* The soil Moisture sensor FC-28 consists of two probes that are used to measure the volumetric content of water.
* The sensor works between the input voltage range of 3.3V to 5V.
* The output voltage given by it is 0 – 4.2V. The output signal appears both in analog form and in digital form.

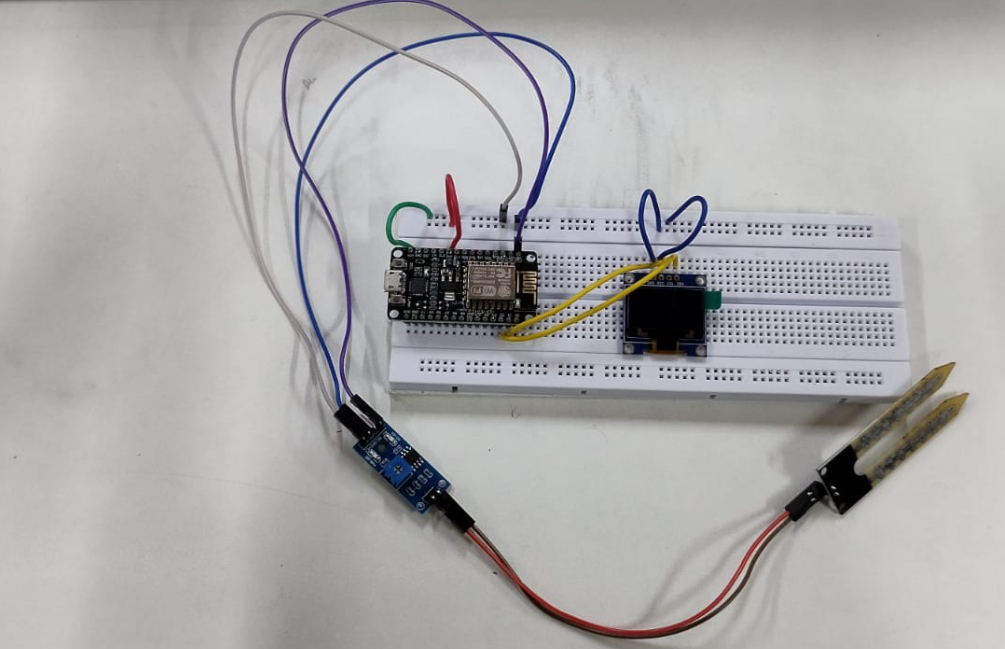
**ARCHITECTURE DIAGRAM**

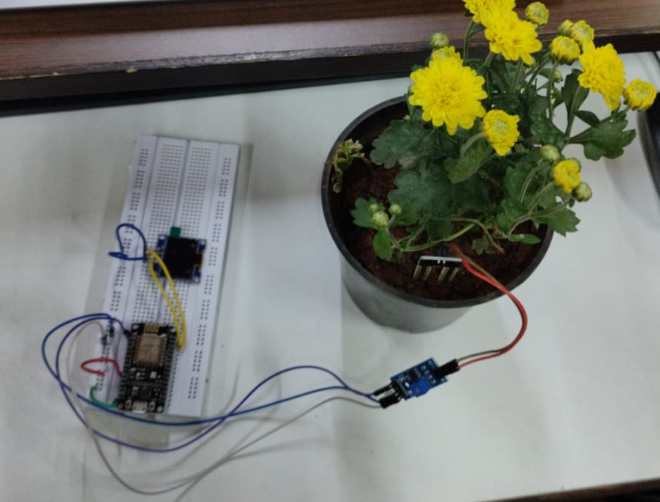


**CIRCUIT DIAGRAM**



* We are using the soil moisture sensor in analog mode.
* So, connect the analog output pin to A0 of Nodemcu.
* Similarly, OLED Display is an I2C Module. So, connect its SDA SCL pin to D2 & D1 of Nodemcu.
* Both the OLED & Soil Moisture Sensor work at 3.3V. So connect their VCC pin to 3.3V of Nodemcu





**CODE**

#include <ESP8266WiFi.h>

#include <SPI.h>

#include <Wire.h>

#include <Adafruit\_GFX.h>

#include <Adafruit\_SSD1306.h>

#define SCREEN\_WIDTH 128 // OLED display width, in pixels

#define SCREEN\_HEIGHT 64 // OLED display height, in pixels

#define OLED\_RESET -1 // Reset pin # (or -1 if sharing Arduino reset pin)

Adafruit\_SSD1306 display(SCREEN\_WIDTH, SCREEN\_HEIGHT, &Wire, OLED\_RESET);

String apiKey = "VLSMWPSDXCXIZI2Y"; // Enter your Write API key from ThingSpeak

const char \*ssid = "Bharadwaj Uppala"; // replace with your wifi ssid and wpa2 key

const char \*pass = "12345679";

const char\* server = "api.thingspeak.com";

const int sensor\_pin = A0; // Connect Soil moisture analog sensor pin to A0 of NodeMCU

WiFiClient client;

void setup() {

Serial.begin(115200);

display.begin(SSD1306\_SWITCHCAPVCC, 0x3C); //initialize with the I2C addr 0x3C (128x64)

display.clearDisplay();

delay(10);

Serial.println("Connecting to ");

Serial.println(ssid);

display.clearDisplay();

display.setCursor(0,0);

display.setTextSize(1);

display.setTextColor(WHITE);

display.println("Connecting to ");

display.setTextSize(2);

display.print(ssid);

display.display();

WiFi.begin(ssid, pass);

while (WiFi.status() != WL\_CONNECTED)

{

delay(500);

Serial.print(".");

}

Serial.println("");

Serial.println("WiFi connected");

display.clearDisplay();

display.setCursor(0,0);

display.setTextSize(1);

display.setTextColor(WHITE);

display.print("WiFi connected");

display.display();

delay(4000);

}

void loop()

{

int moisture\_percentage;

moisture\_percentage = ( 100.00 - ( (analogRead(sensor\_pin)/1023.00) \* 100.00 ) );

Serial.print("Soil Moisture(in Percentage) = ");

Serial.print(moisture\_percentage);

Serial.println("%");

display.clearDisplay();

display.setCursor(0,0); //oled display

display.setTextSize(1);

display.setTextColor(WHITE);

display.println("Soil Moisture Monitor");

display.setCursor(50,20); //oled display

display.setTextSize(2);

display.setTextColor(WHITE);

display.print(moisture\_percentage);

display.setTextSize(1);

display.setTextColor(WHITE);

display.println(" %");

display.display();

if (client.connect(server, 80))

{

String postStr = apiKey;

postStr += "&field1=";

postStr += String(moisture\_percentage);

postStr += "r\n";

client.print("POST /update HTTP/1.1\n");

client.print("Host: api.thingspeak.com\n");

client.print("Connection: close\n");

client.print("X-THINGSPEAKAPIKEY: " + apiKey + "\n");

client.print("Content-Type: application/x-www-form-urlencoded\n");

client.print("Content-Length: ");

client.print(postStr.length());

client.print("\n\n");

client.print(postStr);

Serial.println("Data Send to Thingspeak");

}

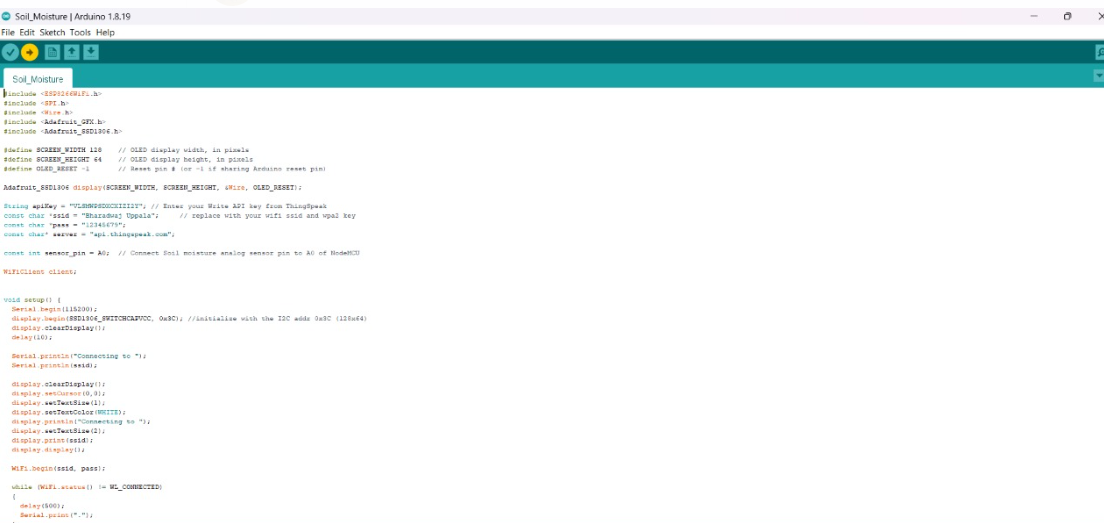
client.stop();

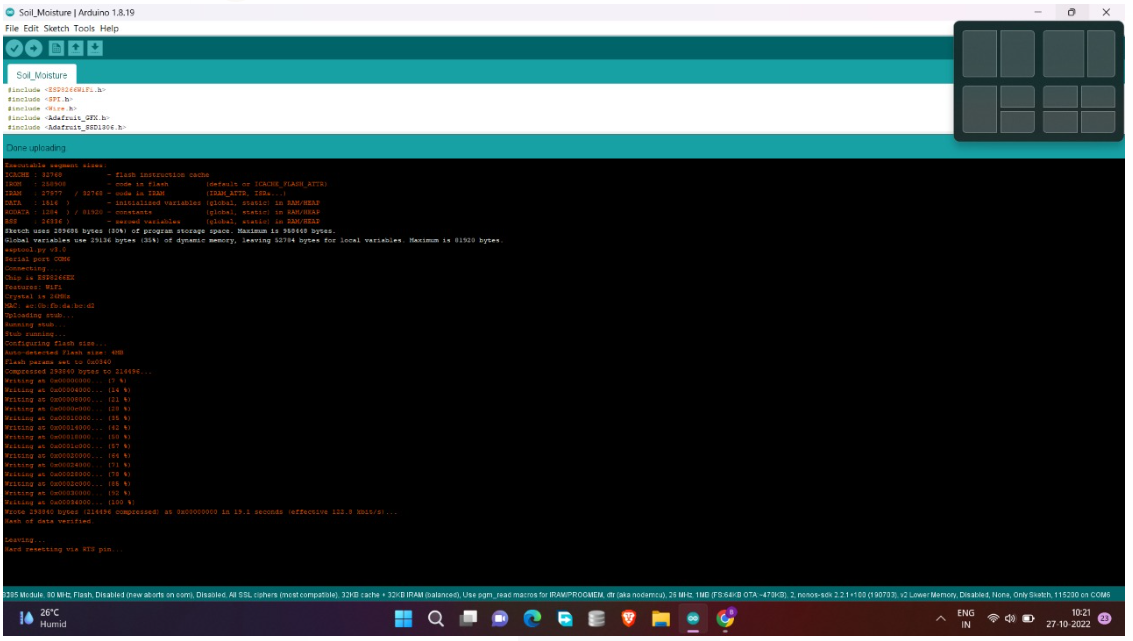
Serial.println("Waiting...");

delay(2000); // thingspeak needs minimum 15 sec delay between updates.

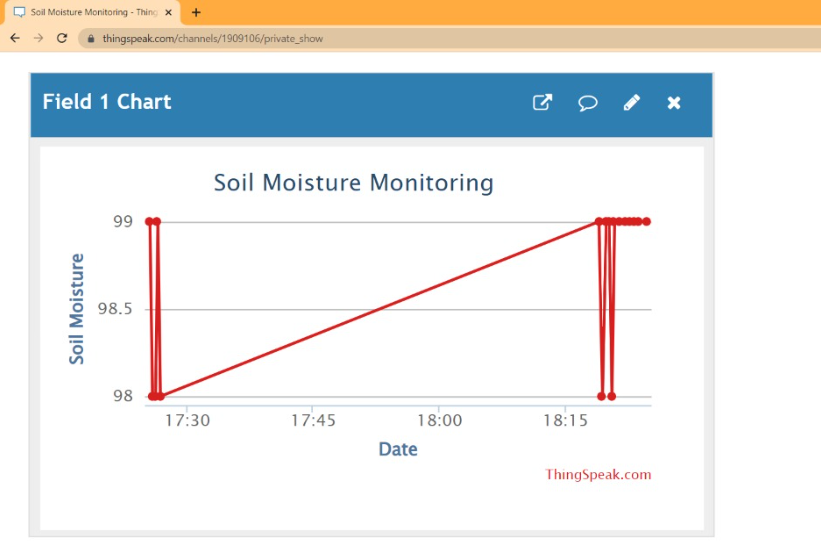
}

**IMPLEMENTATION**





**RESULT**



**CONCLUSION**

The soil moisture response monitoring system designed is very simple to understand and handle. It can be operated by all age-groups of farmer. It can be reprogrammable to addmore features. The moisture is measured up to the root zone of the crop. Thus it can be used to check the moisture value for any crop. Sensor can be placed vertically in the soil to

check the depth of irrigated water and also it can be placed horizontally at different heights in the soil according to the crop. It is user friendly and can also be used by uneducated

farmers.

**FUTURE SCOPE**

Soil moisture sensor can be designed according to the various types of soil. A database can be formed. It can be used to determine the types of acids, alkalis or salts present in

the soil. Salinity of soil can also be calculated by correlating it with the output voltage. Wireless transmission of the output data directly to the user can be done using Zigbee or

Bluetooth. We can get the values from stored data base in PC so that the moisture holding capacity of the soil can be determined.